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TECP 700-700
Materiel Test Procedure 2-2-709*
Aberdeen Proving GroundU. S. ARMY TEST AND EVALUATION COMMAND
COMMON ENGINEERING TEST PROCEDURE

COMMUNICATIONS EQUIPMENT

1. OBJECTIVE

The object of this test procedure is to determine the capability of combat vehicle communications equipment to meet designated operation, space, and durability standards.

2. BACKGROUND

A major factor of command and control is intelligible, audible communications among combat vehicle commander, crew, and supporting elements such as other vehicles, aircraft, and infantry. For this reason, communications equipment in a combat vehicle must be capable of operating under all types of conditions. Moreover, such equipment must be sufficiently compact to be accommodated by the limited stowage and mounting space available in a combat vehicle and, at the same time, be rugged enough to withstand the shocks of firing and cross country operation. All components should be capable of being stowed or mounted in a readily available position without interference with crew functioning.

Electrical power requirements must be kept to a minimum. Voltage transients must be kept within stated limits to prevent damage to communications equipment. In addition items such as slip rings and power sources must be compatible with the communications equipment.

3. REQUIRED EQUIPMENT

- a. Applicable Test Vehicle
- b. Additional Vehicle (required for vehicle noise interference tests)
- c. Receiver-Transmission Station
- d. Calibrated Signal Generator
- e. Power Meter
- f. Dip Meter
- g. Applicable Calibrated Recorder

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4. REFERENCES

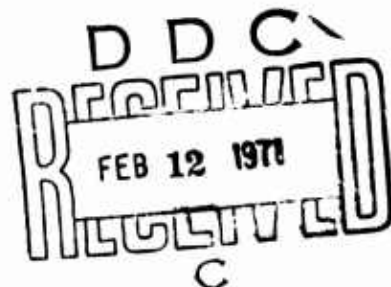
- A. MTP 2-2-506 Durability Testing of Wheeled Vehicles
- B. MTP 2-2-507 Durability Testing of Tracked Vehicles

*Supersedes Ordnance Proof Manual 60-265

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- C. MTP 2-2-550 Environmental Factors
- D. MTP 2-2-601 Electrical Systems (Automotive)
- E. MTP 2-2-613 Broadband Radio Interference Testing for Vehicles and Electrical Equipment - Noncommunication
- F. MTP 2-2-615 Security From Detection
- G. MTP 2-2-803 Human Engineering
- H. MTP 3-2-813 Field of Fire
- I. ASA S3.2-1960 "American Standard Method for Measurement of Monosyllabic Word Intelligibility", American Standards Association, Inc.
- J. Report of Investigation, Failure of Equipment Employing Solid Static Devices, Conducted Jointly by USATECOM and USAECOM, dtd 3 March 1965
- K. Proposed Military Standard, Electrical Circuit 28 Volts DC, Transient Characteristics for Military Vehicles

5. SCOPE

5.1 SUMMARY

This MTP describes procedures for the testing of vehicle communications equipment with respect to the following:

- a. Stowage and mounting
- b. Ease and simplicity of operation
- c. Antenna flexibility
- d. Electrical characteristics and requirements
- e. Vehicle noise interference
- f. Durability in extended operations

NOTE: Although this test procedure is primarily concerned with electromagnetic radio transmissions, other signaling devices require similar performance and durability testing.

5.2 LIMITATIONS

The procedures described in this test deal only with those aspects of installed communications equipment that affect compatibility with other equipment in a combat vehicle. The responsibility for the engineering design of radio and noise suppression equipment is vested in the U. S. Army Electronics Command, and any specialized tests on this equipment should be coordinated with the appropriate agency. Responsibility of vehicular power sources is vested in the U. S. Army Tank Automotive Command.

6. PROCEDURES

6.1 PREPARATION FOR TEST

None

6.2 TEST CONDUCT

6.2.1 Stowage and Mounting Space

Check to see that all radio equipment interphone control boxes and headsets are stowed or mounted in a position to be readily available for use, while at the same time offering no interference with crew functions and presenting no safety hazard.

6.2.2 Ease of Operation

Perform the following:

- a. Conduct human factors procedures in accordance with MTP 2-2-803.
- b. Conduct environmental factors procedures in accordance with MTP 2-2-550.

6.2.3 Antenna Flexibility

Perform the following:

- a. Check out compatibility of externally mounted, flexible antennas with armament functioning by conducting applicable portions of MTP 3-2-813 in order to determine any limits of fire and antenna transversing obstructions.
- b. Record or plot all observations.

6.2.4 Electrical Requirements

6.2.4.1 Power Requirements

The power dissipated by the communications equipment shall be measured by testing in accordance with MTP 2-2-601 as part of the total requirements of the vehicle.

6.2.4.2 Test for Voltage Transients

NOTE: Prior to conducting this test the project engineer shall acquaint himself with data contained in references 4J and 4K. Observe and record effects of voltage transients by conducting applicable portions of MTP 2-2-601.

6.2.5 Vehicle Noise Interference Tests

The communication equipment, external (radio) and internal (intercom system) shall be tested for electromagnetic and acoustical interference under the following conditions. If noise interference is observed, perform sound level measurements, reference MTP 2-2-615.

- a. Gun control system in operation
- b. Ventilating blower in operation
- c. Personnel heater in operation
- d. Auxiliary engine in operation

- e. Main engine in operation
- f. Other appropriate electrical or electromechanical equipment

6.2.5.1 Electromagnetic Interference Tests

Determine the electromagnetic interference of the vehicle and its equipment, operating all equipment under the conditions of paragraph 6.2.5a through 6.2.5f, using the procedures described in MTP 2-2-613.

6.2.5.2 Acoustical Interference Test

Determine the acoustical interference of the vehicle and its equipment under the conditions of paragraph 6.2.5a through 6.2.5f by determining the sound pressure level as described in MTP 2-2-615.

6.2.6 Operations Tests

During the conduct of paragraphs 6.2.5.1 and 6.2.5.2 perform the following:

- a. Establish radio communications with:
 - 1) Fixed location radio receiver/transmitter
 - 2) Vehicle equipped with a radio receiver/transmitter
- b. Operate the vehicle intercom system
- c. Record the effects of electromagnetic and mechanical vibration noise on the ability of the crew and radio operator to:
 - 1) Readily understand incoming radio transmissions (vocal and code) and transmit intelligible radio signals (vocal and code) when:
 - a) Test vehicle is stationary and:
 - (1) Second vehicle is stationary
 - (2) In communication with the fixed radio receiver/transmitter
 - b) Test vehicle is moving and:
 - (1) Second vehicle is stationary
 - (2) In communication with the fixed radio receiver/transmitter
 - 2) Understand all transmissions over the intercom system

6.2.7 Durability in Extended Vehicle Operation

NOTE: The radio shall be operated as part of the weapon system during vehicle durability testing as described in MTP 2-2-506 and MTP 2-2-507.

6.2.7.1 Test Preparation

Perform the following:

a. Check vehicle receivers with a calibrated signal generator to assure coverage of the entire frequency range of variable tuned receivers, or correct frequency for pushbutton type radios.

b. Check vehicle transmitter with the applicable calibrated receiver to assure transmission over the entire frequency range of variable tuned transmitters or correct frequency for pushbutton radios.

c. Utilizing a power meter measure record maximum vehicle transmitter power output.

d. Utilizing a dip meter measure and record maximum vehicle transmitter radiated power.

e. Insure the proper operability of the transmitter-receiver facility of a fixed station (which shall be located within transmitting range of the test vehicle) to:

- 1) Operate at two frequencies (designated by the project engineer) for variable tuned radios.
- 2) Operate at the specific frequencies for pushbutton type radios.

f. Install operating time recording clocks in the transmitter and receiving circuits of the test vehicle communication equipment.

6.2.7.2 Durability Communication Test

During vehicle durability operation, when conducting MTP 2-2-506 or MTP 2-2-507, perform the following:

a. Maintain the receiver "ON" throughout the durability test.

b. Place the transmitter "ON" for 10 minutes each hour.

c. During periods when the radio is in the "receive" mode the fixed station shall transmit voice as follows:

- 1) For a minimum of ten minutes each hour
- 2) For a minimum of two minutes for:
 - a) Each of the designated frequencies for variable tuned radios.
 - b) Each of the specific frequencies for pushbutton radios.

NOTE: Final information in each transmission will announce to the test vehicle crew the next frequency of transmission.

d. Record the frequencies, time, quality, and length of reception from the test vehicle.

e. Transmit twice, at random, during each four hour vehicle operating period, with a minimum of two hours between transmissions, from the test vehicle to the fixed station receiver.

NOTE: During the two transmission periods the frequencies of paragraph c(2) above shall be transmitted for approximately two minutes.

f. Record the frequencies, time, length and quality of transmission for the test vehicle radio.

g. Record total vehicle receiver and transmitter operating times at the completion of the test.

6.2.7.3 Post-Test

Perform the following:

a. Check test vehicle receivers with a calibrated signal generator to assure coverage of the entire frequency range.

b. Utilizing a power meter, measure and record maximum vehicle transmitter power output.

c. Utilizing a dip meter, measure and record maximum vehicle transmitter radiated power.

6.3 TEST DATA

6.3.1 Stowage and Mounting Space

Record user comments on the accessibility of all radio equipment-interphone control boxes and headsets stowed or mounted.

6.3.2 Ease of Operations

Record the following:

a. Data as described in MTP 2-2-803.

b. Data as described in MTP 2-2-550.

6.3.3 Antenna Flexibility Test

Record limits of fire and all obstructions caused by the antennas as described in MTP 3-2-813.

6.3.4 Power Requirements

Record power dissipated by communication equipment in accordance with MTP 2-2-601.

6.3.5 Test for Voltage Transients

Record effects of voltage transients on communications equipment

in accordance with applicable portions of MTP 2-2-601.

6.3.6 Vehicle Noise Interference Tests

6.3.6.1 Electromagnetic Interference Tests

Data shall be collected and recorded as described in MTP 2-2-613 for the following conditions with vehicle stationary and in motion.

- a. Gun control system in operation
- b. Ventilating system in operation
- c. Personnel heater in operation
- d. Auxiliary engine in operation
- e. Main engine in operation
- f. Other equipment in operation

6.3.6.2 Acoustical Interference Tests

Sound level pressure data shall be recorded and collected as described in MTP 2-2-615 for the following vehicle stationary and moving conditions:

- a. Gun control system in operation
- b. Ventilating system in operation
- c. Personnel heater system in operation
- d. Auxiliary engine system in operation
- e. Main engine system in operation
- f. Other equipment in operation

6.3.7 Operations Test

Record the following user comments:

- a. Test vehicle condition (gun control system in operation, vehicle in motion, etc.)
- b. Test vehicle intercom intelligibility (good, fair, poor)
- c. Intelligibility (good, fair, poor) of test vehicle transmission to:

- 1) Second vehicle
- 2) Fixed station

d. Intelligibility (good, fair, poor) of test vehicle reception from:

- 1) Second vehicle
- 2) Fixed station

6.3.8 Durability in Extended Vehicle Operation

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6.3.8.1 Test Preparation

Record the following:

- a. Test vehicle receiver frequency operability
- b. Test vehicle transmitter frequency operability
- c. Test vehicle maximum transmitter power output in decibels
- d. Test vehicle maximum transmitter radiated power.
- e. Test frequencies

6.3.8.2 Durability Communication Test

Record the following:

- a. Time (in day, hour, and minute) and frequency (in megahertz) of fixed station transmission to the test vehicle.
- b. Quality of test vehicle receiver output for fixed station transmitted signals.
- c. Total test vehicle receiver operating time in hours
- d. Time (in day, hour, and minute) and frequency (in megahertz) of test vehicle transmission to the fixed station.
- e. Quality of test vehicle transmission to the fixed station receiver.
- f. Total test vehicle transmitter operating time in hours.

6.3.8.3 Post Test

Record the following:

- a. Test vehicle maximum transmitter power output.
- b. Test vehicle maximum transmitter indicated power.

6.4 DATA REDUCTION AND PRESENTATION

- a. All data shall be summarized to reveal significant results.
- b. Charts and graphs shall be prepared to show data, i.e., obstructions, and interference levels.
- c. Reports will be prepared to show operational hours, component failure, stowage problems, etc.

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